Ultra-Peripheral Coherent ρ^0 Production with STAR

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We report the first observation of coherent ρ^0 production in ultra-peripheral heavy ion collisions[1]. This process is expected to have a large cross section, 380 mb, or 5% of the hadronic cross section at $\sqrt{S_{NN}} = 130$ GeV[2], but has not been previously seen.

In the summer, 2000, the STAR collaboration collected 7 hours of data with a dedicated trigger optimized for ρ^0 detection[1]. Level 0 of the trigger divided the central trigger barrel into 4 quadrants and required two hits that were back-to-back in the transverse plane. Vertical coincidences were rejected as probable cosmic rays. This trigger rate varied from 20 to 40 Hz. The major backgrounds were cosmic rays, beam gas, and debris from upstream interactions[3]. The level 3 trigger reconstructed charged tracks, eliminating events with > 15 tracks in the TPC (out-of-time events) and events outside the collision region (cosmic rays and upstream debris), writing 1-2 events/sec to tape.

The ρ^0 analysis selected events with exactly two tracks that formed a primary vertex. Fig. 1a shows the p_t distribution of the pairs. The peak at $p_T < 100$ MeV/c is due to peripheral production. The final state couples coherently to both nuclei so $p_T < 2\hbar/R_A \sim 60$ MeV/c. Fig. 1b shows the mass spectrum (assuming both tracks are $\pi^{\pm}$) of events with $p_T < 100$ MeV/c; the peak is at the ρ^0 mass (768 MeV/c^2) and width (150 MeV/c^2).

References

[1] F. Meissner and the STAR Collaboration, "Ultra-peripheral collisions," poster presented at Quark Matter 2001.

[2] S. Klein and J. Nystrand, Phys. Rev. **C60**, 014903 (1999).

[3] J. Nystrand and S. Klein, nucl-ex/9811007, in Proc. Workshop on Photon Interactions and the Photon Structure, Lund, Sweden, Sept., 1998.
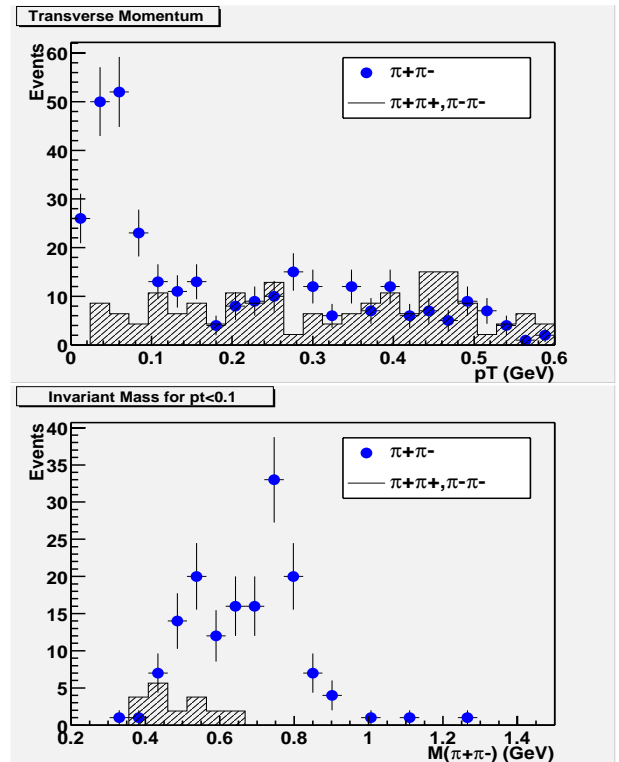
Figure 1: (a) The p_T distribution of all 2-track events with the peripheral collision trigger. The points are oppositely charged pairs, while the hatched region is for like-sign pairs, giving a measure of the combinatorial background. (b) The invariant mass distribution (assuming $\pi\pi$ pairs) for pairs with $p_T < 0.1$ GeV/c.

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